

FORM PTO-1390
(Rev 5-93)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

CUNANT 1398US

U.S. APPLICATION NO.

107 049984

INTERNATIONAL APPLICATION NO.

PCT/GB00/03231

INTERNATIONAL FILING DATE

August 21, 2000

PRIORITY DATE CLAIMED

August 24, 1999

TITLE OF INVENTION

INTERACTIVE SYSTEM FOR REMOTE READING OF UTILITY METERS

APPLICANT(S) FOR DO/EO/US

Bahir AL-OBAIDY and Thamer AL-OBAIDY

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau. (PCT/IB/308 mailed March 1, 2001)
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)) is attached.
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☒ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98 with PTO FORM 1449.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
 - ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification w/Marked-Up Version of Amended Specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:

| | |
|---|--|
| <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Preliminary Examination Report <input checked="" type="checkbox"/> Annexes to Pre. Ex. Rep. <input checked="" type="checkbox"/> International Search Report <input type="checkbox"/> German Novelty Search Report <input checked="" type="checkbox"/> 5 copies of citations <input checked="" type="checkbox"/> Form PCT/IB/308 <input checked="" type="checkbox"/> International Publ. No. WO 01/15114 A1 (Face page only) | <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Copy of Request <input checked="" type="checkbox"/> Submission of Formal Drawings <input checked="" type="checkbox"/> 2 sheets of formal drawings <input checked="" type="checkbox"/> Abstract <input checked="" type="checkbox"/> Applicant Claims Small Entity Status <input type="checkbox"/> Copy of Notification of File Missing Parts <input checked="" type="checkbox"/> International Specification with paragraph numbers |
|---|--|

CERTIFICATION UNDER 37 CFR 1.10

I hereby certify that this Transmittal Letter and the papers indicated as being transmitted therewith is being deposited with the United States Postal Service on this date **February 20, 2002** in an envelope as "Express Mail Post Office to Addressee" Mailing Label Number EV 016960221US addressed to the: Box PCT, Assistant Commissioner of Patents, Washington, D.C. 20231.

Michael J. Bujold
(typed or printed name of person mailing paper)

Michael Bujold
(signature of person mailing paper)

Basic National Fee (37 CFR 1.492(a)(5):
 Search Report has been prepared by the EPO or JPO
 International preliminary examination fee paid

International preliminary examination fee paid
 and all claims satisfied provisions of PCT Article 33(1)(4)
 ENTER APPROPRIATE BASIC FEE AMOUNT

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months
 from the earliest claimed priority date (37 CFR 1.492(e)).

| Claims | Number Filed | Rate |
|--------------------|--------------|------------|
| Total Claims | 32-20 = 12 | x \$16.00 |
| Independent Claims | 1-3 = 0 | x \$84.00 |
| | | + \$280.00 |

Multiple dependent claim(s) (if applicable)

TOTAL OF ABOVE CALCULATIONS =

Reduction by 1/2 for filing by small entity, if applicable. Applicant Claims Small Entity Status. (Note 37 CFR 1.9, 1.27, 1.28).

SUBTOTAL =

Processing fee of \$130.00 for furnishing the English translation later the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).

TOTAL NATIONAL FEE =

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

TOTAL FEES ENCLOSED =

Amount to be:
 refunded \$
 charged \$

- a. ☒ A check in the amount of \$553, to cover the above fees is enclosed.
- b. ☐ Please charge my Deposit Account No. 04-0213 in the amount of \$ to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 04-0213. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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PATENT & TRADEMARK OFFICE



PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Bahir AL-OBAIDY and Thamer AL-OBAIDY
 Serial no. :
 Filed : with an effective filing date of August 21, 2000
 For : INTERACTIVE SYSTEM FOR REMOTE
 READING OF UTILITY METERS
 Group Art Unit :
 Examiner :
 Docket : CUNANT 1398US

The Commissioner of Patents and Trademarks
 Washington, D.C. 20231

SUBMISSION OF FORMAL DRAWINGS

Enclosed please find two (2) sheets of formal drawings which are to be entered in this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,



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1004984-022002

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of : Bahir AL-OBAIDY and Thamer AL-OBAIDY
Serial no. :
Filed : with an effective filing date of August 21, 2000
For : INTERACTIVE SYSTEM FOR REMOTE
READING OF UTILITY METERS
Group Art Unit :
Examiner :
Docket : CUNANT 1398US

The Commissioner of Patents and Trademarks
Washington, D.C. 20231

FIRST PRELIMINARY AMENDMENT

Dear Sir:

By way of preliminary amendment, please amend the above identified application as set forth below.

In the Specification:

Please cancel paragraphs 2, 4, 6, 32 and 36 of the specification, in their entirety, in favor of a clean form of paragraphs 2, 4, 6, 32 and 36 of the specification, without any markings thereon, as follows. Accompanying this response is a copy of the original paragraphs of the specification which show the addition(s) (by underlining and highlighting) and the deletion(s) (by strikeout) to the canceled specification paragraphs. Please enter the replacement specification paragraphs into the record of this case.

In the Claims:

Please cancel claims 1-32, without prejudice or disclaimer of the subject matter therein, in favor of new claims 33-64 as follows.

20022018664001

[002] FIELD OF THE INVENTION

[004] BACKGROUND OF THE INVENTION

[006] SUMMARY OF THE INVENTION

[032] BRIEF DESCRIPTION OF THE DRAWINGS

[036] DETAILED DESCRIPTION OF THE INVENTION

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33. (NEW) A remotely interactive metering system comprising:

sensing mechanism for interfacing with a meter and providing an output signal corresponding to the meter reading;

a meter reading collection hub connecting to the sensing mechanism of several meters, the meter collection hub comprising:

mechanism for converting the output signal from each sensing mechanism and providing a count for each meter associated with each one of the mechanisms;

telecommunication mechanism by which data may be transmitted from the meter reading collection hub to a centralized meter reading server; and

communication mechanism by which the meter reading collection hub may receive real time, time signals; and

a centralized meter reading server.

34. (NEW) The remotely interactive metering system according to claim 33, wherein a plurality of meter reading collection hubs are connected to the centralized meter reading service by telecommunications mechanism.

35. (NEW) The remotely inactive metering system according to claim 33, wherein the sensor mechanism is an integral part of the meter.

36. (NEW) The remotely interactive metering system according to claim 33, wherein the sensor mechanism is located externally of the meter.

37. (NEW) The remotely interactive metering system according to claim 35, wherein the sensor mechanism is situated within easy sensing distance from a rotating disc of the meter.

38. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub is connected to an external terminal of the meter.

39. (NEW) The remotely interactive metering system according to claim 33, wherein the sensor mechanism senses LED signaling from an LED meter display.

40. (NEW) The remotely interactive metering system according to claim 35, wherein the sensor mechanism includes a way for detecting the direction of rotation and jitteriness of a rotating disc of the meter.

41. (NEW) The remotely interactive metering system according to claim 33, wherein the sensors connected to the meter reading collection hub are meters for different utilities of a single premise and/or meters for the same utility of several neighboring premises.

42. (NEW) The remotely interactive metering system according to claim 33, wherein multiplexing mechanism is provided between the sensing mechanism and the meter reading collection hub, to increase the number of sensing mechanisms which may be connected to the meter reading collection hub.

43. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub utilizes digital decimal odometers to convert the signals from the sensing mechanism into unit counts.

44. (NEW) The remotely interactive metering system according to claim 42, wherein the digital decimal odometers are coupled to display dials to provide a visual display.

45. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub comprises mechanisms for recording the readings and storing them temporarily, for subsequent transmission via telecommunication system to the centralized meter reading server.

46. (NEW) The remotely interactive metering system according to claim 45, wherein the meter reading collection hub is provided with processing mechanisms to calculate and store consumption rates, predict unmetered uses from previous recordings and establish normal consumption pattern.

47. (NEW) The remotely interactive metering system according to claim 46, wherein the meter reading collection hub can report deviations from normal consumption patterns.

48. (NEW) The remotely interactive metering system according to claim 33, wherein the metering reading collection hub is connected to the centralized meter reading server by the PSTN network.

49. (NEW) The remotely interactive metering system according to claim 48, wherein the meter reading collection hub is connected to the PSTN network by the telephone line of the household served by the meter reading collection hub.

50. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub is connected to the centralized meter reading server via terrestrial or satellite GSM signaling mechanisms.

51. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub is running TCP/IP and connected to the centralized meter reading server via Internet/PSTN/terrestrial or satellite (GSM) signaling mechanisms.

52. (NEW) The remotely interactive metering system according to claim 48, wherein the telecommunication mechanism operates as a meter server with auto-dial to a specified telephone number.

53. (NEW) The remotely interactive metering system according to claim 48, wherein the telecommunication mechanism operates as a meter server with auto-answering on a specific count of telephone rings.

54. (NEW) The remotely interactive metering system according to claim 33, wherein the telecommunication mechanism is password protected.

55. (NEW) The remotely interactive metering system according to claim 33, wherein the communication mechanism by which the meter reading collection hub receives real-time signals, comprises a radio receiver.

56. (NEW) The remotely interactive metering system according to claim 55, wherein the communication mechanism receives real-time time signals such as "Radio 4" or the "Rugby Signaling System".

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57. (NEW) The remotely interactive metering system according to claim 33, wherein the communication mechanism receives Economy 7 signals.

58. (NEW) The remotely interactive metering system according to claim 33, wherein the real-time time signal is used to synchronize communications of data between the meter reading collection hubs and a centralised meter reading server.

59. (NEW) The remotely interactive metering system according to claim 33, wherein the real-time time signal is used for switching unit rates.

60. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub has back-up battery mechanism.

61. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub has non-volatile storage media.

62. (NEW) The remotely interactive metering system according to claim 33, wherein the meter reading collection hub can report the occurrence and duration of power cuts.

63. (NEW) The remotely interactive metering system according to claim 33, for use in connection with meters for utilities, electricity, gas and water, or for other metered commodities, for example fuel, vending machines or taxi services.

64. (NEW) The remotely interactive metering system substantially as described herein, with reference to and as shown in Figs. 1 and 2 of the accompanying drawings.

REMARKS

Accompanying this response, please find marked-up paragraphs of the specification which overcome some informalities noted in the specification. The undersigned avers that the enclosed replacement paragraph(s) of the specification do not contain any new matter.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,



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10049984-022002

ABSTRACT

A remotely interactive metering system comprises a plurality of meter reading collection hubs (14) connected via a telecommunications network to a centralised meter reading server (24), each meter reading collection hub (14) being connected to a plurality of sensing mechanisms for interfacing with a meter and providing an output signal corresponding to the meter reading, the meter reading collection hub including communication mechanisms (26) for receiving real-time time signals (28) which are used to synchronise transmission of data from the meter reading collection hub (14) to the centralised meter reading server (24).

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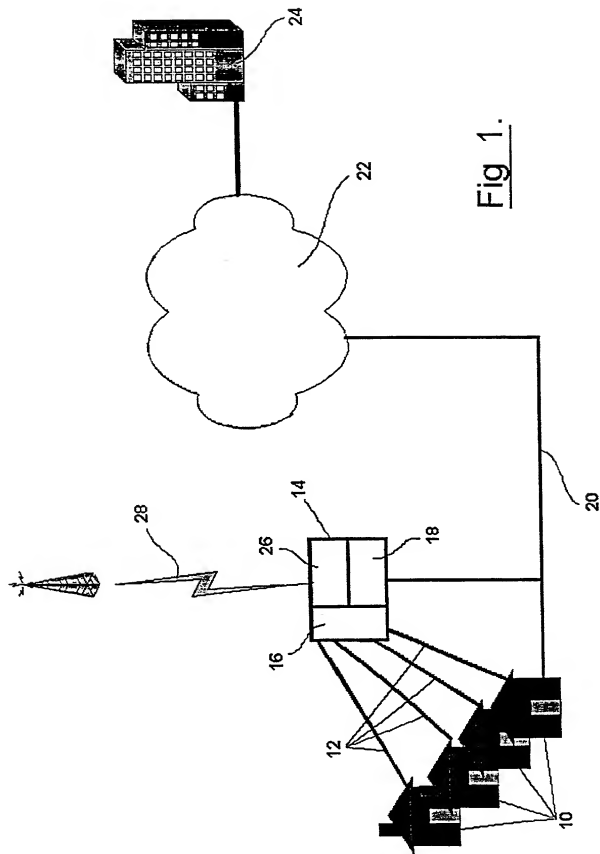


Fig 1.

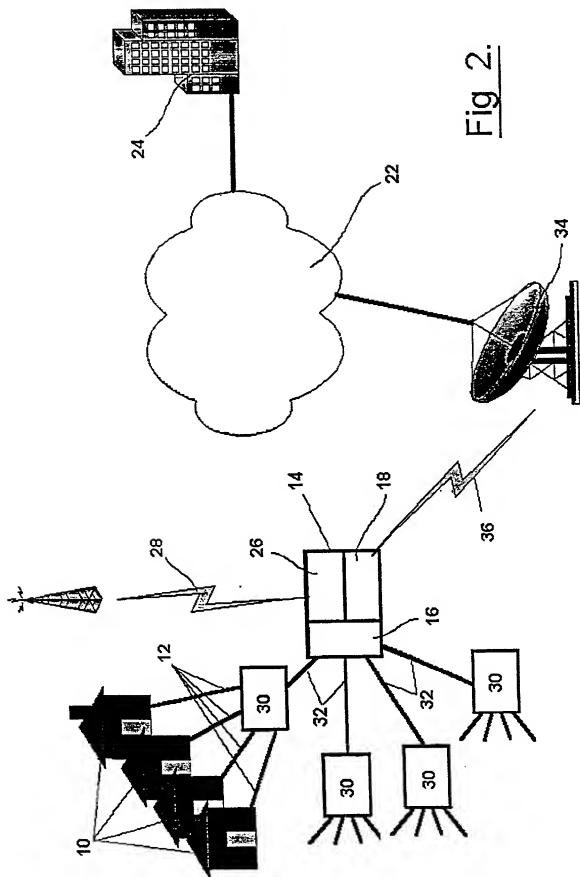


Fig 2.

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INTERACTIVE SYSTEM FOR REMOTE READING OF UTILITY METERS

The present invention relates to a remotely interactive metering system and in particular to a system for automatically reading utility or other forms of meter.

5 According to one aspect of the present invention, a remotely interactive metering system comprises:

sensing means for interfacing with a meter and providing an output signal corresponding to the meter reading;

10 a meter reading collection hub connecting to said sensing means of several meters, the meter collection hub comprising:

means for converting the output signal from each sensing means and providing a count for each meter associated with each one of said sensing means;

15 telecommunication means by which data may be transmitted from the meter reading collection hub to a centralised meter reading server; and

communication means by which the meter reading collection hub may receive real-time, time signals; and

a centralised meter reading server.

20 The sensor means may be an integral part of the meter or may be located externally of the meter. For example, in the case of electricity meters, the sensor means may be situated within easy sensing distance from the rotating disc of the meter. Alternatively, if the meter is provided with an external terminal for reading the units consumed, then this external
25 terminal may be connected to the meter reading collection hub. With meters having a LED display, the sensors may pick up the LED signalling.

In addition to means for sensing the meter reading, the sensor means may

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also comprise means of sensing the direction of rotation and jitteriness. In electricity meters, a disc is located inside electricity meter and rotates freely due to magnetic fields and forces applied upon it through a set of coils mounted inside the meter. Rotation of the disc will clock the amount of consumption of electricity. A reflective silver material and marker set on the side of the disc is detected by a light sensor, to detect the position of the disc. A combination of two of these light sensors will detect the direction of rotation of the disc.

The sensing of rotational movement will be confirmed only when both sensors have detected the marker located on the disc. A unit consumed will be registered only when both of the sensors have recorded the marker.

In normal operational circumstances, the disc jitters, moving backwards and forwards, when the meter is operating with hardly any load carried through it, ie minimal consumption of electricity. The sensors will register a directional rotation only when both of the sensors have simultaneously recorded the marker. Then, one unit of consumption will be registered. This will prevent the false registration of multiple units consumed due to jitteriness of the disc in low load application.

Typically, up to seven meters may be connected to each meter reading collection hub. These meters may be any kind of meters and/or meters for different utilities, for example electricity, water or gas serving one household and/or may be meters for the same utility from several neighbouring households.

Multiplexing may increase the number of meters that may be connected to each meter reading connection hub, to for example 64, where higher densities of meters occur, for example for blocks of flats or industrial

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premises.

5 The meter reading collection hub utilises digital decimal odometers for unit counting. These digital decimal odometers comprise a set of wheels, each of one millimetre in depth. Each wheel has a set of four grooves of an equal length punched through its surface. The outer ring groove lengths are split into two halves. The first half runs parallel to the first inner ring groove and the second half runs alone across its sector. The lengths of these grooves are spread equidistantly on the surface of one sector without grooves. Their position is spread equally, and distance apart, at 10 the same intervals as the groove reader mounted on the reader arm. The width of each groove is wide enough to allow a narrow beam of laser or light ray to penetrate. The grooves will enable that wheel to represent figures 0 - 9 digitally encoded.

15 These digital decimal odometers are fixed with gears which are attached to counter visual dials. This arrangement enables both the visual display of numeric counting and the representation of these decimal numbers electronically.

20 The number of these wheels will match exactly the number of dials displayed on the display unit counter, so for example if there are nine sets of display dials on the electricity meter, then there will be nine sets of these digital decimal odometers.

25 These digital decimal odometers can provide electronically the amount of units consumed instantly at any time. The mechanical devices will eliminate the need for a battery in case of power deprivation. They can be mounted inside a meter or can be driven by pulses from a microprocessor in a separate box to the meter.

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The meter reading collection hub may also be provided with means for recording the readings and storing them temporarily, for subsequent transmission via telecommunication system to the centralised meter reading server. Moreover, processing means may be provided to calculate and store consumption rates, so that the system may predict unmetered uses from previous recordings and establish normal consumption pattern. In this manner, deviations from the normal consumption patterns may be reported prompting further enquiries from the utility board in order to avoid possible fraudulent activities.

The normal PSTN line of one of the household's or a dedicated PSTN line may be used for sending data from the meter reading connection hub to the centralised meter reading server. Alternatively, terrestrial or satellite GSM and its associated signalling protocols may be provided in the meter reading connection hub for this purpose via the Internet.

The telecommunication means may operate as a meter server with auto-dial to a specified telephone number or a meter server with auto-answering on a specific count of telephone rings.

Password protection may also be provided which may be set and altered by the utility board to provide data protection and ensure integrity.

TCP/IP mode for the meter reading collection hub, using a combination of a unique IP address and customer house telephone line or a GSM number, provides a unique identification address. The communication layers for this mode consist of the following:-

Connection to the customer household telephone line with dial-up facility with a fixed number of tries to dial the utility computer site using a free phone number, and after the 'Economy 7' radio signal has triggered the transmission process. Alternatively using the hub

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GSM protocols for instance GPRS, to enable the centralised meter reading server to start a GPRS session using a PSTN line and/or the Internet to download the hub readings.

5 The initial state of the system will have TCP/IP stack loaded into its RAM from the ROM when initially switched on. The TCP/IP stack will have class C address initially for any trial period. This network is a private one and does not have an Internet access. The IP address will be encoded by hardware or software means (via a password protected serial port).
10 The IP address range could then be changed to a registered bigger range (for instance class A) when the system is accepted and in full production.

15 The system uses an FTP (file transfer protocol) application within the TCP/IP suite to transfer the reading back to the host system database, and shut down the connection (telephone line).

20 The centralised meter reading server consists of a modem rack with several modems, TCP/IP stack loaded, and should be configured as a FTP server with a database application running. Modification, editing and billing can be done from the database.

The communication means for receiving real time, time signals, is preferably a radio communication means which may pick up real time, time signals such as "Radio 4" or the "Rugby signalling system".

25 Alternatively the electricity boards "Economy 7" signal may be used for this purpose.

The real time, time signal is used to synchronise communications of data between the meter reading collection hubs and centralised meter reading server. In addition the real time signal may be used for switching unit

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consumption rates, for day/night rating, with seasonally adjusted timing.

5 The meter reading collection hub is preferably empowered by mains electricity. A battery backup system is however preferably provided to maintain operation during power cuts and to avoid loss of data. The battery backup is preferably re-chargeable so that when power is restored, the battery may be re-charged.

Non-volatile storage media, for example SIM media may also be used to store data.

10 The meter collection hub may also report to the utility the occurrence and duration of power cuts.

The digital decimal odometers may also act as visual dials allowing visual reading of the meter.

15 Meter centre calibration units may also remotely display and test the meter sensors accumulative disc revolutions, units consumed, kilowatts and fractions of kilowatts.

The system according to the present application allows direct and accurate collection of meter readings, without any delay, at any time, so that:-

- 20
- a) precise readings of consumed units may be quoted on customer bills, rather than estimated consumed units;
 - b) meter readings can be collected 24 hours a day, 7 days a week, without disturbing the occupants of the buildings;
 - c) the utility billing time cycle is minimised;
 - 25 d) the utility may provide customers with multiple choice of rate consumption, not only bound by the "Economy 7" rate but

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provide other rates to satisfy customer needs;

e) provide cost effectiveness in the following areas:-

i) maximum utilisation of human resources and equipment;

ii) car purchasing or leasing;

iii) fuel;

iv) maintenance;

v) inflation cost linked to the above points;

vi) elimination for the need to use resource in order to collect meter readings.

The system covered the present application also provides the following advantages:-

- a) remote access and bidirectional communication control over non half-hourly monitoring and meter reading;
- b) reporting of powercuts and fraudulent activity immediately;
- c) empowers the utility to offer better customer care by offering variety of rates and precise billing;
- d) use of existing meters and public telephone networks, all the technology used is in use and reliable;
- e) unlimited meter reading collection at will, 24 hours a day 7 days a week;
- f) adhering to OFFER's guidelines in protecting the consumer's interests;
- g) adhering to British approved industrial standards British manufacturing standards (BS9000);
- h) accurate and precise meter readings for billing the consumer, no estimate readings, with single database for customer's information;
- i) environmentally friendly, will encourage the reduction of burning fossil fuels with offering a cheap way of monitoring

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consumption at will and cutting cost of collecting meter readings;

- j) minimal and cost effective installation time and minimal running costs;
- k) allowing effective utilisation of manpower;
- l) design adaptable to meet utility board specifications;
- m) low cost operation and maintenance.

While the system has been described with reference to meters for utilities in general and electricity in particular, the system may also be used for other metered commodities, for example fuel, vending machines or taxi services.

The invention is now described, by way of example only, with reference to the accompanying drawings, in which :-

Fig. 1 is a diagrammatic illustration of one embodiment of the present invention; and

Fig. 2 is a diagrammatic illustration of an alternative embodiment of the invention.

As illustrated in Fig. 1 a remotely interactive metering system includes a series of meter reading collection hubs 14 (only one shown). The meter reading collection hubs 14 are connected via cables 12, each to a plurality of sensing means (not shown) for reading utility meters in a plurality of neighbouring households 10.

The meter reading collection hub 14 includes means 16 for converting and processing the signals from each of the sensing means, into counts for each of the meters associated therewith and for temporarily storing the

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data.

The meter reading collection hub 14 also includes telecommunication means 18 which is connected to a telephone line 20 of one of the households 10, by which it is connected to the PSTN network and via that to a centralised meter reading server 24.

The meter reading collection hub 14 also has radio receiving means 26, by which it may receive real-time, time signals 28.

Means 16 continuously monitors the meters connected thereto, calculating total consumption and consumption rates and storing the data for subsequent transmission to the centralised meter reading server 24. This data is transmitted by telephone line 20, at specific times, the timing being synchronised by the real-time signal 28. The real-time signal may furthermore be used to switch means 16, for different charge rates, for example "Economy 7" thereby taking into account seasonally adjusted timing.

In a modification illustrated in Fig. 2, the sensor means are connected to the meter reading collection hub 14 via multiplexing means 30, so that the number of meters connected to the hub 14 may be typically increased from 7 to 64.

Moreover, in the embodiment illustrated in Fig. 2, the meter reading collection hub 14 is connected to the PSTN network and thus to the centralised meter reading server 24, by means of a GSM satellite signal 36, thereby avoiding the need to use a customer telephone line. Alternatively, a GSM terrestrial signal may be used.

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CLAIMS

1. A remotely interactive metering system comprising:
sensing means for interfacing with a meter and providing an output
signal corresponding to the meter reading;
5 a meter reading collection hub connecting to said sensing means of
several meters, the meter collection hub comprising:
means for converting the output signal from each sensing
means and providing a count for each meter associated with
each one of said sensing means;
10 telecommunication means by which data may be transmitted
from the meter reading collection hub to a centralised meter
reading server; and
communication means by which the meter reading collection
hub may receive real time, time signals; and
15 a centralised meter reading server.
2. A remotely interactive metering system according to Claim 1 in
which a plurality of meter reading collection hubs are connected to the
centralised meter reading service by telecommunications means.
3. A remotely interactive metering system according to Claim 1 or 2 in
20 which the sensor means is an integral part of the meter.
4. A remotely interactive metering system according to Claim 1 or 2 in
which the sensor means is located externally of the meter.
5. A remotely interactive metering system according to Claim 3 or 4,
in which the sensor means is situated within easy sensing distance from a
rotating disc of the meter.
25

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6 A remotely interactive metering system according to Claim 1 or 2 in which the meter reading collection hub is connected to an external terminal of the meter.

5 7. A remotely interactive metering system according to any one of Claims 1 to 5 in which the sensor means senses LED signalling from an LED meter display.

8 A remotely interactive metering system according to any one of Claims 3 to 7, in which the sensor means includes means for detecting the direction of rotation and jitteriness of a rotating disc of the meter.

10 9. A remotely interactive metering system according to any one of the preceding claims in which the sensors connected to the meter reading collection hub are meters for different utilities of a single premise and/or meters for the same utility of several neighbouring premises.

15 10. A remotely interactive metering system according to any one of the preceding claims in which multiplexing means is provided between the sensing means and the meter reading collection hub, to increase the number of sensing means which may be connected to the meter reading collection hub.

20 11. A remotely interactive metering system according to any one of the preceding claims in which the meter reading collection hub utilises digital decimal odometers to convert the signals from the sensing means into unit counts.

25 12. A remotely interactive metering system according to Claim 10 in which the digital decimal odometers are coupled to display dials to provide a visual display.

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13. A remotely interactive metering system according to any one of the preceding claims in which the meter reading collection hub comprises means for recording the readings and storing them temporarily, for subsequent transmission via telecommunication system to the centralised meter reading server.

14. A remotely interactive metering system according to Claim 13 in which the meter reading collection hub is provided with processing means to calculate and store consumption rates, predict unmetered uses from previous recordings and establish normal consumption pattern.

15. A remotely interactive metering system according to Claim 14, in which the meter reading collection hub can report deviations from normal consumption patterns.

16. A remotely interactive metering system according to any one of the preceding claims in which the metering reading collection hub is connected to the centralised meter reading server by the PSTN network.

17. A remotely interactive metering system according to Claim 16, in which the meter reading collection hub is connected to the PSTN network by the telephone line of the household served by the meter reading collection hub.

18. A remotely interactive metering system according to any one of Claims 1 to 15, in which the meter reading collection hub is connected to the centralised meter reading server via terrestrial or satellite GSM signalling means.

19. A remotely interactive metering system according to any one of Claims 1 to 15, in which the meter reading collection hub is running

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TCP/IP and connected to the centralised meter reading server via Internet/PSTN/terrestrial or satellite (GSM) signalling means.

20. A remotely interactive metering system according to any one of Claims 16 to 18, in which the telecommunication means operates as a meter server with auto-dial to a specified telephone number.

21. A remotely interactive metering system according to any one of Claims 16 to 18, in which the telecommunication means operates as a meter server with auto-answering on a specific count of telephone rings.

22. A remotely interactive metering system according to any one of the preceding claims in which the telecommunication means is password protected.

23. A remotely interactive metering system according to any one of the preceding claims in which the communication means by which the meter reading collection hub receives real-time signals, comprises a radio receiver.

24. A remotely interactive metering system according to Claim 23, in which the communication means receives real-time time signals such as "Radio 4" or the "Rugby Signalling System".

25. A remotely interactive metering system according to any one of Claims 1 to 22, in which the communication means receives Economy 7 signals.

26. A remotely interactive metering system according to any one of the preceding claims, in which the real-time time signal is used to synchronise communications of data between the meter reading collection hubs and a

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centralised meter reading server.

27. A remotely interactive metering system according to any one of the preceding claims, in which the real-time time signal is used for switching unit rates.

5 28. A remotely interactive metering system according to any one of the preceding claims in which the meter reading collection hub has back-up battery means.

10 29. A remotely interactive metering system according to any one of the preceding claims in which the meter reading collection hub has non-volatile storage media.

30. A remotely interactive metering system according to any one of the preceding claims in which the meter reading collection hub can report the occurrence and duration of power cuts.

15 31. A remotely interactive metering system according to any one of the preceding claims for use in connection with meters for utilities, electricity, gas and water, or for other metered commodities, for example fuel, vending machines or taxi services.

20 32. A remotely interactive metering system substantially as described herein, with reference to and as shown in Figs. 1 and 2 of the accompanying drawings.

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
1 March 2001 (01.03.2001)

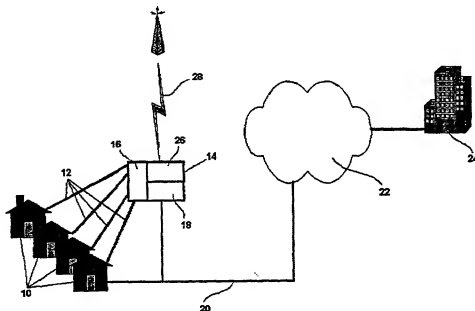
PCT

(10) International Publication Number
WO 01/15114 A1

- (51) International Patent Classification: G08C 17/02
- (21) International Application Number: PCT/GB00/03231
- (22) International Filing Date: 21 August 2000 (21.08.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
9919875.6 24 August 1999 (24.08.1999) GB
0018800.3 1 August 2000 (01.08.2000) GB
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Millison Grove, Solihull, West Midlands B90 4UN (GB).
- (81) Designated States (national): AE, AL, AM, AT, AU, AZ,
BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK,
DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL,
IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,
LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT,
RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA,
UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM,
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,
IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG,
CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- Published:
— With international search report.
— Before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments.

[Continued on next page]

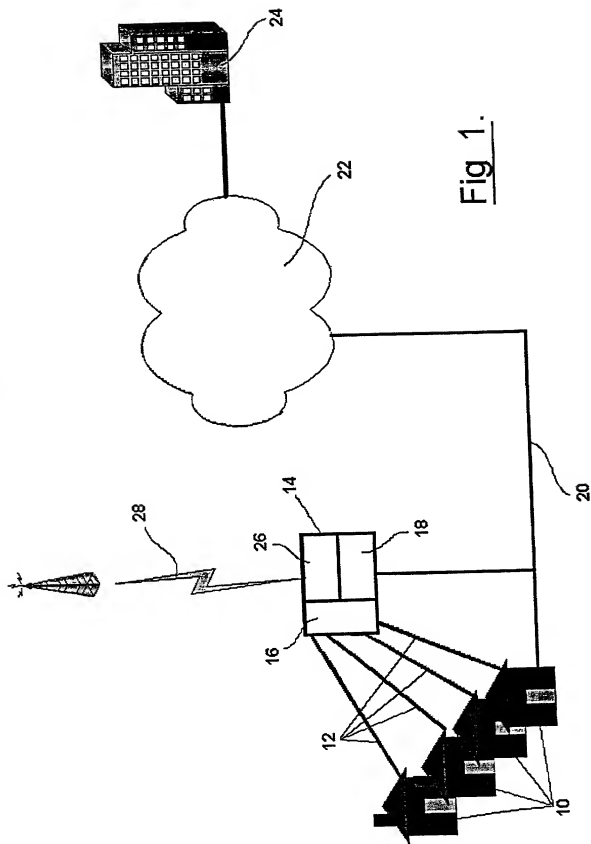
(54) Title: INTERACTIVE SYSTEM FOR REMOTE READING OF UTILITY METERS



(57) Abstract: A remotely interactive metering system comprises a plurality of meter reading collection hubs (14) connected via a telecommunications network to a centralised meter reading server (24), each meter reading collection hub (14) being connected to a plurality of sensing means for interfacing with a meter and providing an output signal corresponding to the meter reading, the meter reading collection hub including communication means (26) for receiving real-time time signals (28) which are used to synchronise transmission of data from the meter reading collection hub (14) to the centralised meter reading server (24).

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Fig 1.

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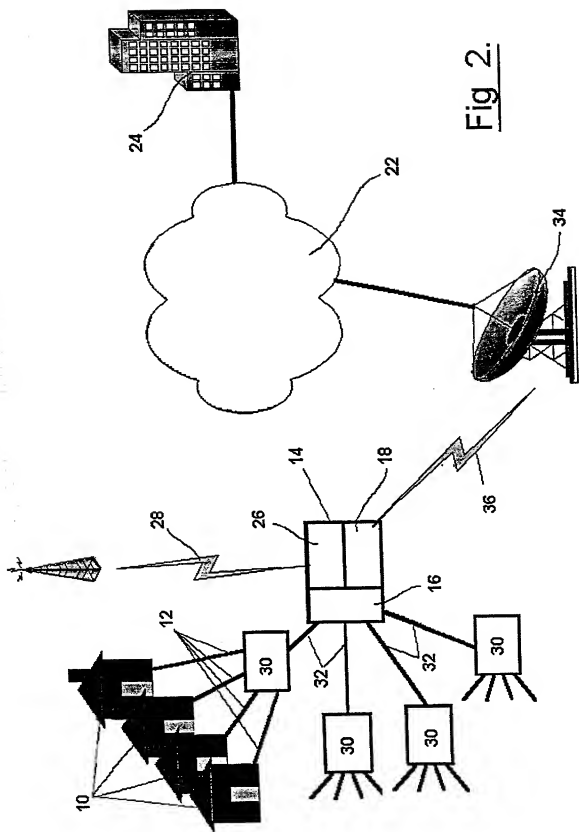


Fig 2.

**IMPORTANT NOTICE RE
DUTY OF CANDOR AND GOOD FAITH**

The Duty of Disclosure requirements of Section 1.56(a), of Title 27 of the Code of Federal Regulations, are as follows:

A duty of candor and good faith toward the Patent and Trademark Office rests on the inventor, on each attorney or agent who prepares or prosecutes the application, and on every other individual who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application. All such individuals have a duty to disclose to the Patent Office all information they are aware of which is known to be material to patentability of the application. Such information is material where there is a substantial likelihood that a reasonable examiner would consider it important in deciding whether to allow the application to issue as a patent. The duty is commensurate with the degree of involvement in the preparation or prosecution of the application.

By virtue of this regulation, each inventor executing the Declaration for the filing of a patent application acknowledges his/her duty to disclose information of which he/she is aware and which may be material to the examination of the application.

Inherent in this is the duty to disclose any knowledge or belief that the invention:

- (a) was ever known or used in the United States of America before his/her invention thereof;
- (b) was patented or described in any printed publication in any country before his/her invention thereof or more than one year prior to the actual filing date of the United States patent application;
- (c) was in public use or on sale in the United States more than one (1) year prior to the actual filing date of the United States patent application; or
- (d) has been patented or made the subject of inventor's certificate issued before the actual filing date of the United States patent application in any country foreign to the United States on an application filed by him/her or his/her legal representative(s) or assign(s) more than twelve (12) months before the actual filing date in the United States.

NOTE: The "Information" concerned includes, but is not limited to, all published applications and patents, including applicant(s) and assignee(s) own, United States or foreign application(s) and patent(s), as well as any other pertinent prior art known, or which becomes known, to the inventor or his/her representative(s). Where English language equivalents of foreign language documents are known, they should be identified and, when possible, copies supplied. Failure to comply with this requirement may result in a patent issued on the application being held invalid even if the known prior art which is not supplied is material to only one claim of that patent.

If there is any doubt concerning whether or not a citation is "material" to patentability of the application, it is better to err on the side of safety and disclose such art to the United States Patent Office.

COMBINED DECLARATION AND POWER OF ATTORNEY

(Original, Design, National Stage of PCT, Supplemental)

As a below named inventor, I hereby declare that:

TYPE OF DECLARATION

This declaration is of the following type: (check one applicable item below)

- ☐ original
- ☐ design
- ☐ supplemental
- ☒ National Stage of PCT
- ☐ divisional (see added page)
- ☐ continuation (see added page)
- ☐ continuation-in-part (see added page)

INVENTORSHIP IDENTIFICATION

My/our residence, post office address and citizenship is/are as stated below next to my/our name. I/We believe that the named inventor or inventors listed below is/are the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought on the invention entitled:

TITLE OF INVENTION

Interactive System for Remote Reading of Utility Meters

SPECIFICATION IDENTIFICATION

The specification of which: (complete (a), (b) or (c))

- (a) ☐ is attached hereto.
- (b) ☐ was filed on _____ as
☐ Serial No. _____ or
☐ Express Mail No. _____ as Serial No. (not yet known) and was
amended on _____ (if applicable).
- (c) ☒ was described and claimed in PCT International Application No. CT/GB00/03231
filed on 21.08.2000 and as amended under PCT Article 19 on
_____ (if any).

POWER OF ATTORNEY

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name(s) and registration number(s))

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Registration No. 32,018
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☐ Attached as part of this Declaration and Power of Attorney is the authorization of the above-named attorney(s) to accept and follow instructions from my representative(s).

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ACKNOWLEDGMENT OF REVIEW OF PAPERS AND DUTY OF CANDOR

I/We hereby state that I/we have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I/We acknowledge the duty to disclose to the United States Patent Office all information which is known to be material to patentability of this application as defined in § 1.56 of Title 37 of the Code of Federal Regulations.

PRIORITY CLAIM

I/We hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me/us on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

EARLIEST FOREIGN APPLICATION(S), IF ANY FILED WITHIN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

| COUNTRY | APPLICATION NO. | DATE OF FILING (day, month, year) | PRIORITY CLAIMED UNDER 37 USC 119 |
|---------|-----------------|--------------------------------------|---|
| GB | 9919875.6 | 24.08.1999 | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| GB | 0018800.3 | 01.08.2000 | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |
| | | | <input type="checkbox"/> YES <input type="checkbox"/> NO |

ALL FOREIGN APPLICATION(S), IF ANY FILED MORE THAN 12 MONTHS (6 MONTHS FOR DESIGN) PRIOR TO THIS U.S. APPLICATION

☐ I/We hereby claim the benefit, under 35 U.S.C. 119(e), of any United States provisional application(s) listed below.

| | | |
|-----------------------|------------------------|---|
| Application Number(s) | Filing Date (MM/DD/YY) | <input type="checkbox"/> Additional provisional application numbers are listed on a supplementary priority data sheet PTO/SB/02B attached hereto. |
| | | |

DECLARATION

I/We hereby declare that all statements made herein of my/our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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